coolness of the air, the vapor more readily condenses upon the dust particles. The dust particles thus become larger and consequently not so effective in turning back the blue rays alone, but others are also reflected and a grayish effect is produced. In a single location the blue of the sky may appear bluer at one time than another. The sky is oftentimes said to be very blue when some white cumulus clouds are outlined against it. The sky is then a deep blue by contrast with the brilliant white. After a shower, when the lower stratum of air is washed of its coarse dust particles, a deeper and purer blue is the result.

As one looks toward the sun, especially at sunset, the reds are prominent. The dust particles are then between the sun and the observer, and so the blues are reflected away from the observer while the reds pass on to the observer's eye. One might suppose that the sun ought to appear red rather than white when one looks directly at it, because the stratum of air containing the dust is between the observer and the sun and thus there would be a diminution of the shorter wave rays to the eye. This is explained by assuming that the sun is really blue if observed from a point beyond our atmosphere; the subtraction of the blue rays as they are scattered by the particles in our atmosphere is just sufficient to produce the white sun as it appears to us.

The same mail brings us the latest contribution of Lord Rayleigh to this subject, viz, an article published by him in the April number of the L. E. D. Phil. Mag. (5) XLVII, pp. 375–384. In this article Lord Rayleigh shows that we may not need to have recourse to the suspended particles of foreign matter, solid or liquid, but that in the absence of these we should still have blue sky if the molecules of the atmospheric gases are large enough or massive enough to produce either diffraction or selective reflection. The same train of argument can be applied to the case of a beam of light passing through a shower of falling raindrops or through a mist or a cloud. As an illustration the following example is computed. Let a be the radius of a raindrop or cloud particle, expressed in centimeters as the unit of length; n the number of drops per cubic centimeter; x the length of path of the ray of light through the cloud. Then the length of path required in order to reduce the intensity of the light from 1 down to 0.37, or in the ratio 2.7 to 1 is given by:

$$x = \frac{1}{n \pi a^2}$$

Suppose that $a = \frac{1}{20}$ of a centimeter and $n = \frac{1}{1000}$ that is to say, suppose there is one drop of 1 millimeter in diameter for every liter of space, then the transmitted light will be reduced to one-third (0.37) of the original intensity when it has passed through 1 kilometer of the resulting hazy air. According to this theory a distant point of light seen through a shower of rain ultimately becomes invisible, not by failure of definition, but by loss of intensity (either the absolute intensity or that relative to the intensity of the scattered light in the neighborhood of the object) due to the diffractive action of the raindrops or fog particles.

Lord Rayleigh adds:

If the view suggested in the present paper that a large part of the light from the sky is diffracted from the molecules themselves be correct, then the observed incomplete polarization at 90° from the sun may be partly due to the molecules behaving rather as elongated bodies with indifferent orientation than as spheres of homogeneous material.

ABSTRACTS OF UNIVERSITY THESES.

In order to attain the degree of Master of Arts or Master of Science, and especially that of Ph. D., all universities require the candidates to submit theses upon special subjects which they have investigated in their courses of study. These theses often contain facts and principles of general importance to science. In European universities it is quite common for such theses to be published, and as we have remarked in the MONTHLY WEATHER REVIEW for September, 1898, page 413, the thousands of theses that have been published within the past century constitute an important portion of the grand structure called science. In so far as the theses at American universities bear upon the work of the Weather Bureau, the Editor will be glad to receive from the authors either full abstracts or the originals for publication in the MONTHLY WEATHER REVIEW. The number of theses submitted by successful candidates for the degree of Ph. D., in the summer of 1898, in some branch of science was as follows:

Chicago	12	Wisconsin	2
Yale	11	Bryn Mawr	1
Johns Hopkins	19	Leland Stanford, Jr.	2
Harvard	11	Nebraska	2
Pennsylvania	8	Brown	1
Columbia	10	California	1
Cornell	11	Columbian	1
Clark	12	Minnesota	0
Michigan	0		
New York	1	Total	105

In addition to the universities we must also consider the schools of technology, thus, in the catalogue of the Massachusetts Institute of Technology for the year 1898–99, we find enumerated 204 theses of successful candidates, five of whom took the degree of Master of Science, while the remainder took the degree of Bachelor of Science. The thorough courses of instruction in dynamics, thermodynamics, hydraulics, and pneumatics given at this institution justify the hope that among these many candidates there must be at least a few whose attention has been turned toward the problems of meteorology.

STORM CENTERS IN THE PACIFIC.

The Pilot Chart of the North Pacific Ocean for the month of May, 1899, contains a synoptic weather chart of the eastern portion of the North Pacific Ocean for Greenwich noon of March 7, 1898. This is one of the few cases in which a fairly satisfactory synoptic chart has been published showing the isobars and winds around a storm center in the North Pacific. The abundance of reports received by the U. S. Hydrographic Office, will, we hope, encourage that important office to compile and publish such charts daily, for there could be no more important contribution to our knowledge of the meteorology of the ocean. In the present case an important storm center is shown to be central at N. 33°, W. 132°, midway between San Francisco and Honolulu, directly in the path of many sailing vessels and steamers. The daily map of the Weather Bureau shows that at this time the low area extended eastward across the Rocky Mountain Plateau region, and that storm centers were also present there. This is, therefore, a case of a very long oval, almost a trough, stretching in a northeast or east-northeast and southwest direction, between the tropical high area on the Pacific and one that at that time prevailed in the eastern portion of the American Continent.

The mere fact that such extensive troughs, containing several special centers of low pressure, can exist for several days, moving as a whole eastward, while the individual lows may move either southeast or northeast, suffices to show that the thin layer of air near the surface, within which the clouds and rain and high winds occur, is but a small portion of the whole atmospheric disturbance. The latter generally begins with a trough of low pressure and but slight cloudiness; as the clouds rapidly increase and the sun's heat is absorbed by them, the lower winds increase, the pressure falls, rain sets in, and special low areas develop within the trough.

The special low centers and cyclonic winds may be formed, according to Espy's and Ferrel's views, as a consequence of the formation of clouds and rain, and the disturbance of thermal equilibrium, but the original trough of low pressure appears to be a mechanical result of the general circulation of the atmosphere which forms the several tropical areas of high pressure and the troughs that separate them, including